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ABSTRACT

These guidelines for in-service and preservice teacher education related to the conversion to the metric system were developed from a survey of published materials, university faculty, and mathematics supervisors. The eleven guidelines fall into three major categories: (1) design of teacher training programs, (2) teacher training, and (3) evaluation of materials. Each guideline is stated in some detail, and a rationale for each is provided. Target populations for in-service and preservice training in the metric system are identified, and tables indicating the applicability of each guideline for these populations are provided. (SD)

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Final Report of Objective #3

An Examination of Existing Guidelines for Programs for the Preservice and Inservice Education of Teachers in Metric Education and the Modification of These and the Development of New Ones if Deemed Necessary

by

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The following guidelines were developed from existing guidelines, journal articles, a survey of over one hundred colleges, and the detailed reactions from a selected panel of university faculty, state education personnel, NCTM representatives, researchers, and public city and suburban school mathematics supervisors.

METRIC GUIDELINES
INSERVICE AND/OR PRESERVICE

I Designing Teacher Training

Guideline 1.

The following objectives should be followed in designing preservice and/or inservice training:

a. Preservice/inservice training for going metric should be tightly structured, well-organized, and condensed into a short time span, shortly before teachers begin to teach measurement units.

b. Teachers, administrators, support personnel, and parents should receive training to heighten their metric awareness, including an awareness of the need to change to a metric system, and to give them first-hand metric measurement experiences.

Rationale: A. Teachers will view more positively training that they will soon be able to use and thus will be more likely to retain what they learn.

B. A metric education program that involves administrators, support personnel, and parents is more likely to be successful.

Guideline 2.

Teacher training sessions dealing with classroom measurement activities should be designed to accomplish the following objectives:

a. Help teachers to understand that measurement is a procedure for comparing what is to be measured with a suitable standard. To do this general measurement activities with

nonstandard measures should precede the development of the metric system as the standard system of measurement.

B. Provide teachers with a model instructional program that conforms to the logic of measurement and to the logic of the child.

c. Help teachers find ways to use measurement activities as an integral part of the mathematics program.

d. Introduce teachers to techniques for implementing and evaluating activity-oriented measurement programs.

Rationale: A. For an effective metric education program teachers must understand how children learn to measure as well as developing a personal understanding of measurement and the metric system.

B. For a metric education program to be effective teachers must be able to implement and evaluate measurement activities.

Guideline 3.

Teaching the metric system is a multidisciplinary responsibility falling primarily within mathematics and science. The metric system should not be considered a unique and distinct subject within the curriculum, but should be used at every opportunity in as many subject areas as possible.

Rationale: The metric system will touch many aspects of life and therefore students should be exposed to the widest possible set of applications.

II Teacher Training

Awareness

Guideline 4.

Teachers should have experiences with a variety of hands-on activities similar to those that will be used with students.

Rationale: A. Measurement is best learned through an activity approach.

B. Use of the metric system will help teachers learn the system.

C. Teachers are more likely to teach in ways that are similar to the ways they were taught.

Scope and Sequence

Guideline 5.

Activity oriented measurement experiences for teachers and children should be planned to include the following learning components: language development, estimation and verification, simple matching and comparisons, ordering, simple relations and mapping.

Rationale: A. Teachers and students learn most effectively through an activity approach.

B. The activities for teachers and students should follow a logical sequence that reflects how people learn to measure.

Guideline 6.

In the training of both teachers and students estimation and verification should be emphasized in measurement activities.

Rationale: Estimation helps develop a feeling for the size of units and leads to the goal of "thinking metric."

Metric Measurement

Guideline 7.

With both teachers and students conversions between the SI and U.S. Customary Systems should be avoided. With persons not familiar with SI, informal comparisons may be made between the systems though comparisons with the environment are preferable (a litre of milk is a little more than a quart). Complicated arithmetic and the memorization of conversion factors should be avoided.

Rationale: Conversions interfere with the ability to "think metric" by fostering dependence on the Customary System.

Guideline 8.

Conversions within the metric system should be limited to common units adjacent in size (100 millimetres = 10 centimetres), or to conversions with practical applications (3000 g = 3 kg). Such conversions should emphasize the "tenness" of the system.

Rationale: A. Conversions that have practical applications should be emphasized.

B. Teachers should be helped to appreciate the simplicity of a decimalized measurement system.

Guideline 9.

Teachers should be aware that they should emphasize and provide practice with those units of measurement that will be used in daily living.

Rationale: Units of measure are best leaned through their use.

Guideline 10.

Teachers should be aware of rules of style and spelling, according to SI, which should be followed, some of which are:

a. In pronunciation of metric prefixes, the accent should be placed on the first syllable.

b. In spelling, either metre or meter is correct. It is a matter of personal preference.

c. Symbols derived from names of people are capitalized (C, J, P, K, V, W). There are a few other infrequently used symbols which are capitalized such as Tm, Gm, Mm, Pm, Em.

d. The ultimate goal in metric education is to eliminate references to "weight". To avoid confusion, use mass to refer to the quantity of an object.

e. Symbols for units do not have a plural form.

f. A prefix symbol and a unit symbol form a single unit with no space between them. (km not k m)

g. Exponential indices should be used to express "square" and "cubic" measure. (cm^3)

h. A capital L is used as a symbol for litre when there is no prefix. A lower case l is used when there is a prefix (ml).

i. Symbols should not be punctuated with periods. With SI, periods are used only after symbols which occur at the end of sentences.

j. Spaces, not commas, should be used to separate groups of three digits (25 000 m) because in some countries commas are used as decimal markers.

k. In measurement situations, fractions should usually be expressed in decimal form.

l. When numbers less than one are expressed, a zero should precede the decimal point. (0.1 mg)

Rationale: To make the metric system a truly international system certain rules of spelling, pronunciation, symbols, and notation should be followed.

Evaluating Materials

Guideline 11.

Teachers should be made aware that curricular materials should reflect a genuine concern for how and when children learn to measure and that they follow an appropriate sequence, such as:

a. Comparison between objects,
b. Comparing nonstandard units with objects,
c. Comparing objects to be measured with SI units,
d. Choosing measurement units of appropriate size for specific tasks.

Rationale: A. Teachers must be able to evaluate materials to avoid costly mistakes in purchasing.

B. To be effective, materials must conform to how and when children learn to measure.

Possible targets to be impacted by the metric guidelines were identified as the following:

Preservice: Early Elementary Teachers (K-2)
Elementary Teachers (3-6)
Junior High Teachers
Secondary Teachers
College Professors
Special Education Teachers
School Administrators
State Education Personnel
Board of Cooperative Services Personnel

Inservice: Early Elementary Teachers (K-2)
Elementary Teachers (3-6)
Junior High Teachers
Secondary Teachers
College Professors
Special Education Teachers
School Administrators
State Education Personnel
Board of Cooperative Services Personnel

These named targets are referred to as the designated clientele in this report.

The attached matrix matches the guidelines by number and brief descriptive words with the clientele with an applicability rating of A, B, or C where

A = Guideline has direct applicability
B = Guideline may have applicability to designated clientele
C = Guideline does not appear to have applicability.

PRESERVICE EDUCATION

GUIDELINES	Early Elementary Teachers (K-2)	Elementary Teachers (3-6)	Junior High Teachers	Secondary Teachers	College Professors	Special Education Teachers	School Administrators	State Education Personnel	Board of Cooperative Services Personnel
#1. Training	A	A	A	A	A	A	A	A	A
#2. Classroom Measurement Act.	A	A	A	B	C	A	A	C	C
#3. Multidisciplinary	A	A	A	A	A	A	A	B	B
#4. Hands-On Activ.	A	A	A	A	C	A	A	C	C
#5. Learning Components	A	A	A	A	B	A	A	C	C
#6. Estimation-Verification	A	A	A	A	A	A	A	C	C
#7. Avoiding Conversions	A	A	A	A	A	A	A	C	C
#8. Conversions Within SI	A	A	A	A	A	A	A	B	B
#9. Practical Emphasis	A	A	A	A	A	A	A	C	C
#10. Rules	A	A	A	A	A	A	A	B	B
#11. Curriculum Materials	A	A	A	B	B	A	A	C	C

INSERVICE EDUCATION

GUIDELINES	Early Elementary Teachers (K-2)	Elementary Teachers (3-6)	Junior High Teachers	Secondary Teachers	College Professors	Special Education Teachers	School Administrators	State Education Personnel	Board of Cooperative Services Personnel
#1. Training	A	A	A	A	A	A	A	A	A
#2. Classroom Measurement Activ.	A	A	A	B	B	A	A	B	C
#3. Multidisciplinary	A	A	A	A	A	A	A	A	A
#4. Hands-On Activ.	A	A	A	A	A	A	A	B	C
#5. Learning Components	A	A	A	A	A	A	A	C	C
#6. Estimation-Verification	A	A	A	A	A	A	A	B	B
#7. Avoiding Conversions	A	A	A	A	A	A	A	B	B
#8. Conversions Within SI	A	A	A	A	A	A	A	A	A
#9. Practical Emphasis	A	A	A	A	A	A	A	B	A
#10. Rules	A	A	A	A	A	A	A	A	A
#11. Curriculum Materials	A	A	A	A	A	A	A	B	B

Once the guidelines were developed and the clientele identified, possible dissemination vehicles were explored. Implementation of the guidelines could be carried out by workshops, printed materials, structured courses (credit or non-credit), media (televiaion, filmstrips, movies, film loops, etc.) or some other form such as someone tells you, a kit, or home-study program or individualized-independent type study programs.

A workshop seems to be the best way to disseminate most of the guidelines to the identified clientele. There was less uniformity among the panelists as to the second best way. Different styles of presentations varied as evidenced by the following chart.

Cost of each suggested dissemination vehicle was difficult to determine because time could vary with structured courses with credit courses costing more than non-credit ones. Workshops could be expensive per session but when the cost is accounted for per participant it might be the least expensive vehicle. Media would cost less than structured courses and could be used to enhance both workshops and courses. Printed materials is the least expensive way to disseminate guidelines but is less effective than a workshop or media or a home-study activities approach kit. Therefore cost effectiveness will have to be determined on an individualized level.

SUGGESTED DISSEMINATION VEHICLES
FOR IDENTIFIED GUIDELINES

GUIDELINES	BEST METHOD	SECOND BEST METHOD
#1. Training	Workshop with printed materials	Printed materials or any vehicle
#2. Classroom Measurement Activities	Workshop	Structured Course and/or Media
#3. Multidisciplinary	Workshop and printed materials	Media
#4. Hands-On Activities	Workshop	Structured Course
#5. Learning Components	Workshop	Structured Course
#6. Estimation and Verification	Workshop	Structured Course or Media
#7. Avoiding Conversions	Workshop or Media or Someone tells you	Someone tells you or any vehicle
#8. Conversions Within SI	Printed Materials and Media	Media or any vehicle
#9. Practical Emphasis	Workshop	Printed Materials
#10. Rules	Printed Materials or Media or someone tells you	Printed Material or Media
#11. Curriculum Materials	Workshop	Structured Course or any vehicle